Lessons Learned during HS3, believed useful to future airborne science missions using Global Hawk:

Schedules

1) GH Staffing shortfalls sometimes result in a focus on near-term activities. Perform advance planning with schedules. High-risk items should have a due date and responsible POC.
    a. Seek input from the broader team: crew, IT, science, etc.
    b. Track schedule and deliverables on a weekly basis
2) Pay particular attention to schedules for science team travel
    a. Confirm that PIs are traveling on the days expected and showing up (in the GHOC-E POR, hangar, office, etc.) on the days and times expected
    b. The monthly science telecom is a good forum to ask these types of questions.
3) Project management and GH management should regularly coordinate their internal schedules and plans. For example, responsibilities for country clearances, documentation, COAs, waivers, reviews, and meetings must be clearly understood.
4) Be aware of overtime, crew rest, and crew schedules during deployments. These can impact science flight opportunities. AC crew can exhaust all overtime early in the week, delaying or preventing flight/work later in the week. AFRC requires a down day after 7 work days in a row (i.e., the 8^{th} day down).
5) Maintain awareness of planned maintenance schedule(s) (nozzle replacement, N2 tank certifications, for example).
6) Be aware of local "down-days" or events (e.g., airshows, rocket launches, pony swims, …) that can impact flight schedules & accommodations.

Flight Planning & Tracking

7) Conduct a dry run and MTS training. It is particularly important to have pilot participation in the Dry Run, and to have pilots address questions and identified problems.
8) Assess and seek tracking options for participating non-NASA aircraft. Get as many participating aircraft as possible on MTS. Also add products (e.g., cloud top heights, radar) to MTS that are mission specific. Generate a coordination plan with other aircraft.
9) Clarify/confirm early with GH manager and/or flight crew if science is desired on transit.
10) Operations manuals and team notebooks (IT, Mission Director, Mission Science, etc.) are a good practice for GH missions to preserve team knowledge through staff or shift changes. For extended deployments, overlap between teams that swap members is essential for training and passing "in-field" lessons. Similarly, for long flights, overlap between mission scientists and instrument teams is essential.
11) GH flight crew and science should discuss mission objectives, flight goals, and limitations before transit or the first science flight. Mission Science should confirm the crew's understanding of rules/goals.
12) Mission science and GH pilots should agree upon the best ways to communicate and coordinate science proposed flight paths and pilot submitted flight plans. In addition, mission science and GH pilots should agree upon the method(s) for communicating changes with each other during flight, and the necessary lead times for doing so. This information should be shared with all shifts of both teams.

13) Have a plan for how to communicate changes in takeoff and/or landing times to all pertinent staff (WFF range, safety, wildlife, chase pilots, etc.)
14) Check www.flightradar24.com to assess commercial traffic in the science flight area.

Communication

15) Provide new forecasters and new mission scientists a thorough orientation on expectations/duties.
16) Confirm that instrument staff knows procedures for both KU and iridium communication.
17) For WFF or other deployment site: Establish frequent and detailed communication between WFF protective services, badging and COMSEC. Provide individual access levels for each participant several months later. Foreign national badging must be done 90 days in advance and personnel may require full time escorts.
18) For WFF or other deployment site: Start discussions on badging very early in the project and assign one team member to track the changes and be knowledgeable of current status and policies.
19) Include GH Crew Chief(s) & pilots in communications about hangar details such as fuel, power, and GH communication requirements.
20) Request 0730 hangar meetings on both coasts when operations or staffing require it.

Deployment

21) GHOC pre-deployment testing must include both the FOR and POR.
22) Ensure GHOC operator has time in their schedule to make changes to headsets in POR. Assign someone to check headset comms in the POR prior to the first flight with all suggested changes communicated to the GHOC operator.
23) Ensure PI's don't leave POR before landing without permission. A landing abort is a possibility.
24) Clarify procedures, location, and expectations for pre-CST and CST activities. If you are deploying remotely, pre-CST and CST science/instrument should be conducted from the remote site to insure proper communications with GH.
25) Maintain awareness of foreign nationals on the science team. Some discussions may be restricted to US citizens only. Be aware of ITAR issues.
26) Request a spares plan (e.g., fly-away kits) for deployment.
27) Consider AFRC's RDO schedule and airfield openings when planning integration and operations; a waiver for RDO/holiday on deployment is very necessary to a weather focused project.
28) Upon arrival at deployment and at shift change, review of procedures and documentation is prudent.
29) Co-locate the GH management and project/science management during deployment. Close communication is essential.
30) Plan for early fuel/tank delivery on deployment. Be aware that cold fuel may be necessary for operations in the tropics, sub-tropics, and polar regions.
31) Write an orientation package for all participants prior to deployment.
32) Have a safety brief and evacuation plan for participants upon arrival.
33) Set up a physical layout plan for instrument teams (lab space), crew, science teams, management, etc. Make sure these spaces are properly outfitted (e.g., tables, power, internet, …).

Other

34) Clarify expectations for analysis, engineering and acceptance of a new instrument to the payload. Set up a coordination plan with a deliverables schedule.
35) HS3 mission durations were 25-26 hours max. Payload and environment affect altitude performance and flight duration.